

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10)

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Docket No.

2002JP311

Serial No.

10/519,242

Filing Date

December 22, 2004

Examiner

WU, Ives J.

Group Art Unit

1713

Invention: COMPOSITION FOR ANTIREFLECTION COATING AND METHOD FOR FORMING PATTERN



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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-301268
 (43)Date of publication of application : 13.11.1998

(51)Int.Cl. G03F 7/004
 G03F 7/039
 H01L 21/027

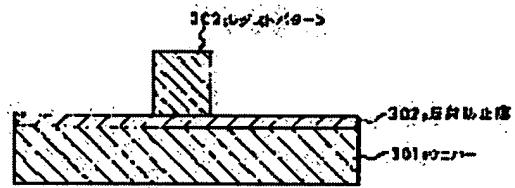
(21)Application number : 09-126278 (71)Applicant : NEC CORP
 (22)Date of filing : 30.04.1997 (72)Inventor : ITANI TOSHIRO

(54) REFLECTION PREVENTING FILM MATERIAL

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent contraction or trailing of a resist pattern on a reflection preventing film which is peculiar to a chemically amplifying resist, by adding one of or both of an acid compd. and a basic compd. to the antireflection film.

SOLUTION: An acid compd. or a basic compd., or both of these are added to a reflection preventing film material consisting of a crosslinking agent and a solvent, and the addition is controlled according to the acidity of a chemically amplifying resist to be used on the reflection preventing film, namely, according to the acidity of the acid produced from a photoacid producing agent. Thereby, the contraction and trailing of a resist pattern can be prevented. This is because the acidity is controlled to be almost same on the interface between the resist film 303 and the antireflection film 302 so that the deblocking reaction of the positive resist does not proceed on the interface between the resist film 303 and the reflection preventing film 302. Moreover, no excess changes in the compsn. is required to the resist material, the gradient of solubility characteristics which largely influence the resist resolution can be maintained large, and higher resolution can be obtd.



LEGAL STATUS

[Date of request for examination] 30.04.1997

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3031287

[Date of registration] 10.02.2000
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right] 18.07.2001

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CLAIMS

[Claim(s)]

[Claim 1] The antireflection film ingredient characterized by the thing it comes to add either an acid compound or the basic compounds, and both in the antireflection film ingredient which contains a cross linking agent and a solvent at least.

[Claim 2] The antireflection film ingredient with which the addition of the acid compound to add or a basic compound is characterized by being 10 % of the weight from the pair cross linking agent ratio 1 in an antireflection film ingredient according to claim 1.

[Claim 3] The antireflection-film ingredient characterized by using said antireflection-film ingredient according to claim 1 or 2 in a chemistry multiplier system resist.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention] Especially this invention is exposed about the ingredient for antireflection film through the mask or reticle describing the semiconductor integrated circuit pattern of a request of the chemistry multiplier system resist formed on the semi-conductor substrate, and relates to the substrate antireflection-film ingredient used in case negatives are developed using a developer and a photoresist pattern is formed after PEB processing.

[0002]

[Description of the Prior Art] In the conventional optical lithography, it was what used g line (436nm) and i line (365nm) for the exposure light, and the dissolution suppression mold positive resist which used novolak resin for base resin and used naphthoquinonediazide for the sensitization agent as the resist was in use.

[0003] However, it was in the situation that the lithography using the excimer laser light (248nm, 193 etc.nm, etc.) which is far-ultraviolet light more advantageous to detailed-izing is needed, optical absorption is too large, and a good resist pattern is not obtained by the conventional g line and the resist for i lines as the resist with detailed-izing of the latest semiconductor device, and sensibility also increases substantially.

[0004] The chemistry multiplier system resist using the sensitization reaction of the acid catalyst generated from a photo-oxide generating agent is originated to such a problem, and it is becoming in use as the resist for short wavelength lithography, and a resist for electron beam lithography as which high sensitivity is required. This chemistry multiplier system resist (chemically amplified resist) is a resist by which induction of the catalytic reaction is carried out and insolubilization (negative mold) or solubilization (positive type) is promoted to a developer in continuing heat treatment (postexposure BEKU-EB) with the acid generated in exposure including the acid generator as a sensitization agent in a resist.

[0005] The description of a chemistry multiplier system resist is using resin with dramatically high transparency, by this, the effect of the reflected light from a substrate substrate became large to the lithography using the conventional g line and the resist for i lines, and its need of using an antireflection film (it also being called anti-reflectivecoating;ARC) has increased.

[0006] Although the organic system antireflection film which consists of a cross linking agent and a solvent has been used in the conventional g line and an i line lithography as an antireflection film, also in KrF excimer laser lithography, this has been used continuously.

[0007] This organic system antireflection film had the trouble when the acidity of a resist is high, that skirt length of a resist pattern 603 arose as a chemistry multiplier system resist is a positive type, and it is shown in drawing 2 to the acidity of the antireflection film, and the vena contracta arises in a resist pattern 503, and it is shown in drawing 3, when the acidity of a resist is low, when membranous acidity was not controlled but it used as a substrate of a chemistry multiplier system resist.

[0008] The approach which some approaches are proposed, for example, adds an acid or a base to the

chemistry multiplier system resist itself conventionally as an approach for aiming at solution of this problem is learned (for example, refer to the publication of JP,7-72628,A).

[0009]

[Problem(s) to be Solved by the Invention] However, by the approach of adding an acid or a base to the above-mentioned conventional chemistry multiplier system resist itself, although the vena contracta of the resist pattern on the antireflection film and skirt length are cancelable, the inclination of the steepest place of the light exposure dependency of the dissolution property over the developer of a resist and the dissolution property of affecting definition most especially becomes small.

[0010] This is equivalent to definition deteriorating and means that there is a trouble it not only cannot demonstrate the original resist engine performance, but that dimensional accuracy deteriorates in connection with dissolution contrast falling.

[0011] Especially the definition of the photoresist pattern which originates in degradation of such a dissolution rate property to detailed pattern formation and degradation of dimensional accuracy are fatal.

[0012] As mentioned above, the antireflection film ingredient itself needs to be improved.

[0013] Therefore, it is originated in view of the above-mentioned technical problem, and this invention has the object in offering the vena contracta of the resist pattern on the antireflection film peculiar to a chemistry multiplier system resist, and the antireflection-film ingredient which cancels skirt length.

[0014] Moreover, this invention can obtain a rectangle resist pattern, improves definition and dimensional accuracy, and aims at offering the antireflection film ingredient which enables high integration of a device pattern while it attains the above-mentioned object.

[0015]

[Means for Solving the Problem] In order to attain said object, the antireflection film ingredient of this invention is characterized by the thing it comes to add either an acid compound or the basic compounds, and both in the antireflection film ingredient which contains a cross linking agent and a solvent at least.

[0016]

[Embodiment of the Invention] The gestalt of operation of this invention is explained below. In the antireflection film ingredient with which the antireflection film ingredient of this invention contains a cross linking agent and a solvent at least in the gestalt of the desirable operation, it comes to add an acid compound, a basic compound, or both.

[0017] Thus, in the gestalt of operation of this invention, it can prevent that a resist pattern becomes the vena contracta and a skirt length configuration by adding according to the acidity of the chemistry multiplier system resist which uses an acid compound, basic compounds, or these both on an antireflection film, i.e., the acidity of the acid generated from a photo-oxide generating agent, into the antireflection film ingredient which consists of a cross linking agent and a solvent. Acidity becomes almost the same by the interface of the resist film and the antireflection film, and this is for not going on by the deprotection reaction of a positive resist being the interface of the resist film and the antireflection film.

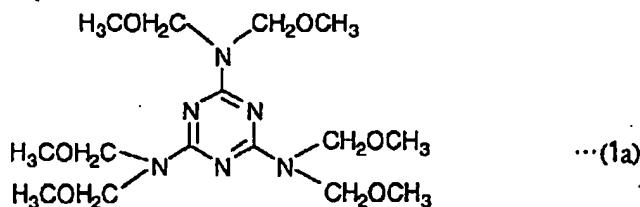
[0018] Moreover, since a resist ingredient is not forced excessive presentation modification consequently, the inclination of the dissolution property of affecting resist resolution most can be kept large, and high resolution-ization is attained.

[0019]

[Example] the more concrete example about the gestalt of operation of above-mentioned this invention -- with -- **** -- the example of this invention is explained below with reference to a drawing that it should explain. In one example of this invention, an antireflection-film ingredient consists of a cross linking agent (hexamethoxy methyl melamine) and a solvent (Propylene Glycol Monomethyl Ether Acetate, propylene-glycol-monomethyl-ether acetate-GMEA), as shown below.

[0020]

[Formula 1]



架橋劑

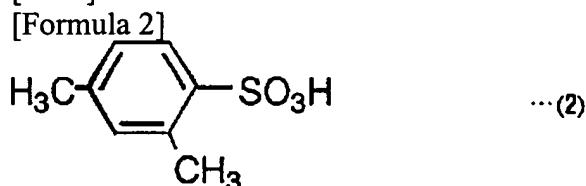


溶劑

[0021] The benzenesulfonic acid shown in this as a chemical formula 2 below is added.

[0022]

[Formula 2]



[0023] For example, by adding benzenesulfonic acid pair cross linking agent ratio 5% of the weight, when 2 component chemistry magnification resist which consists of polyhydroxy styrene resin which has a t-BOC (t-butoxycarbonyl) radical in a protective group, and a photo-oxide generating agent is used, as shown in drawing 1 as drawing of longitudinal section, the rectangle resist pattern 303 can be obtained.

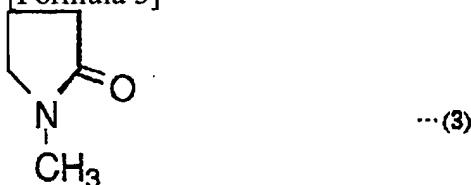
[0024] Acidity becomes almost the same, this is the interface of the resist film and the antireflection film, and it is [the deprotection reaction of a positive resist is the interface of the resist film and the antireflection film, and] for not going on.

[0025] Although effectiveness with the same said of negative resist is acquired, it originates in the crosslinking reaction of negative resist not advancing by the interface of the resist film and an antireflection film in this case.

[0026] Moreover, as an example of the base to add, N methyl pyrrolidone shown as a chemical formula 3 is listed to below.

[0027]

[3327] [Formula 3]



[0028] Depending on the class of resist, the acidity of the antireflection film is high and the vena contracta arises in a resist pattern. In such a case, a rectangle resist pattern can be obtained by adding a basic compound.

[0029] an acid compound and a basic compound -- when adding any, in accordance with the acidity of

the resist ingredient used on the antireflection film, and the acid especially generated from a photo-oxide generating agent, it is necessary to choose the class and an addition moderately In any case, about 10 % of the weight is [an addition] desirable from the pair cross linking agent ratio 1.

[0030] Thus, according to this example, since a rectangular resist pattern is obtained, dimensional accuracy can be raised. Specifically, definition and dimensional accuracy were able to aim at improvement in 10% or more.

[0031] In addition, in this invention, the class of compound to add is not limited to what was shown in the above-mentioned chemical formulas 2 and 3 as an example in an antireflection film that what is necessary is just to demonstrate acidity or basicity.

[0032]

[Effect of the Invention] As explained above, it prevents that the resist pattern of a chemistry multiplier system resist used on it becomes the vena contracta and a skirt length configuration according to the antireflection-film ingredient of this invention, and the effectiveness that the definition of resist original can be demonstrated is done so.

[0033] Moreover, according to this invention, by choosing the class of the acid to add and base, and an addition suitably, the resist pattern configuration on the antireflection film can be controlled, and definition can be raised.

[0034] Furthermore, according to this invention, since a rectangular resist pattern is obtained, the effectiveness that definition and dimensional accuracy can be raised is done so. Especially to detailed pattern formation, the effectiveness is large and can form a rectangular photoresist pattern with sufficient repeatability.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the pattern sectional view of one example of the chemistry multiplier system positive resist formed on the antireflection film of this invention.

[Drawing 2] It is the pattern sectional view of the chemistry multiplier system positive resist formed on the conventional antireflection film.

[Drawing 3] It is the pattern sectional view of the chemistry multiplier system positive resist formed on the conventional antireflection film.

[Description of Notations]

301, 501, 601 Wafer

302 Antireflection Film

502 602 The conventional antireflection film

303, 503, 603 Chemistry multiplier system positive type resist pattern

[Translation done.]